Instrument Incubator

Stratospheric Aerosol and Gas Experiment (SAGE) IV Pathfinder

Completed Technology Project (2017 - 2020)

Project Introduction

We propose to develop and build a Stratospheric Aerosol and Gas Experiment (SAGE) IV Pathfinder measurement system to demonstrate a new imaging solar occultation technique that enables a sustainable solution to NASA's mandate under the Clean Air Act to monitor stratospheric ozone and to extend the SAGE record of stratospheric aerosol optical depth, a critical component of climate change. Leveraging over 40 years of solar occultation experience at NASA Langley Research Center (LaRC), our innovative approach will make high-precision, SAGE-quality measurements that are insensitive to pointing uncertainties of previous occultation instruments at a significant cost reduction by targeting development for an inexpensive 6U CubeSat sensorcraft rather than a traditional full-sized instrument and spacecraft bus mission. SAGE IV's reduced form factor configuration uses existing commercially available hardware assembled in a novel configuration leading to a significant reduction in cost. Furthermore, our SAGE IV sensorcraft concept, when operating as a constellation, provides enhanced geographic coverage and redundancy. The objective of our investigation is to develop, demonstrate, and validate a laboratory SAGE IV prototype through the IIP work proposed herein, enabling a follow-on transition to a low-risk flight mission. Under the IIP, our expert team, leveraging existing work performed under NASA LaRC Internal Research and Development (IRAD) funding, will (1) finalize the SAGE IV laboratory instrument design, (2) assemble the SAGE IV laboratory prototype, and (3) demonstrate the ability of the SAGE IV system to produce high-precision radiometric measurements via laboratory characterization and direct sun-viewing testing. SAGE IV will observe and image the Sun as a radiometric source in various spectral channels between 370 nm and 1050 nm. Our team will utilize proto-flight design techniques to the extent possible and will implement interfaces for a preselected small satellite bus to position the IIP development for a later flight opportunity. Our proposed development will address the technical challenges of obtaining and characterizing a commercially available flight candidate detector; controlling stray light within our novel, small telescope design; characterization of the integrated optical system; implementation of embedded control functions using a Xilinx System on Chip, and end-to-end system characterization/validation including new pointing algorithms necessary for sensorcraft operation. By successfully completing the proposed development work, our team will advance the technology readiness level (TRL) of essential instrument systems from TRL 3 to TRL 5 over 3 years. This IIP will advance the state of the art and pave the way for a future constellation of sensorcraft capable of affordably meeting NASA's objective to preserve the continuity of the stratospheric ozone and aerosol data records.

Stratospheric Aerosol and Gas Experiment (SAGE) IV Pathfinder

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Instrument Incubator

Instrument Incubator

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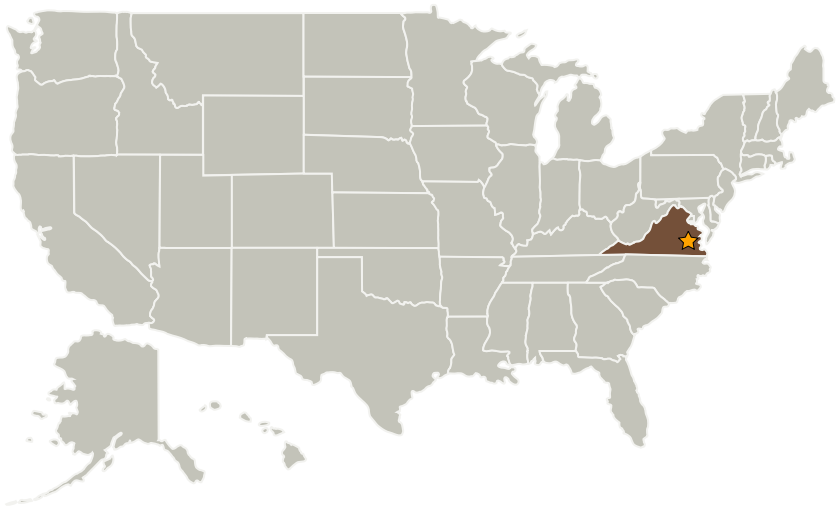
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Management

Program Director:
Pamela S Millar

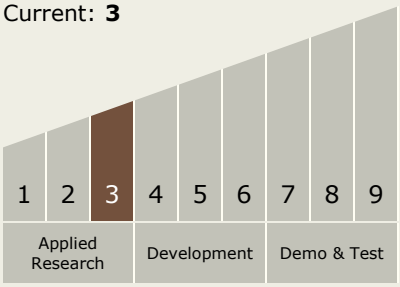
Program Manager:
Parminder S Ghuman

Principal Investigator:
Robert P Damadeo

Co-Investigators:
Joseph M Zawodny
Joseph F Gasbarre
Michael P Mccormick
Rebecca W Bales
Charles A Hill

Technology Maturity (TRL)

Start: **3**
Current: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.3 Optical Components

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Target Destination

Earth